

## CLAIMS

What is claimed is:

1. An apparatus comprising:
  - a cellular map of cellular communication cells in a geographic area;
  - a road map of vehicular roads in substantially the same geographic area; and
  - a traffic flow analyzer coupled to the cellular map and the road map to determine vehicular traffic in at least one part of the geographic area.
2. The apparatus of claim 1 wherein the at least one part of the geographic area comprises at least one cell of the cellular communication cells.
3. The apparatus of claim 1 wherein the at least one part of the geographic area is expressed in geographic terms including a reference to at least one of the vehicular roads.
4. The apparatus of claim 1 further comprising:
  - means for determining a delta over time in occupancy data for at least one cell of the cellular communication cells.
5. The apparatus of claim 1 further comprising:
  - a communication link for transmitting information concerning the vehicular traffic.
6. The apparatus of claim 5 wherein the communication link comprises:
  - a link to cellular devices which are coupled to the cellular communication cells.
7. The apparatus of claim 5 wherein the communication link comprises:
  - means for transmitting the information onto the internet.
8. The apparatus of claim 1 further comprising:
  - a processor coupled to the traffic flow analyzer.
9. The apparatus of claim 1 further comprising:
  - a map overlay mechanism for correlating the cellular map and the road map.

1 10. A cellular communication device for communicating with a cellular system, the cellular  
2 communication device comprising:  
3 a receiver to receive communications from the cellular system;  
4 a transmitter to transmit communications to the cellular system;  
5 map storage to store a map; and  
6 an analyzer coupled to the receiver to receive cell occupancy data from the cellular system  
7 and to the storage to access the map to determine traffic in at least one cell of the cellular system  
8 according to the occupancy data and the map.

1 11. The cellular communication device of claim 10 further comprising:  
2 means for requesting the cell occupancy data; and  
3 storage to store the cell occupancy data.

1 12. The cellular communication device of claim 10 wherein:  
2 the cellular communication device further comprises data storage to store the occupancy data;  
3 the occupancy data includes first occupancy data and second occupancy data for the at least  
4 one cell; and  
5 the analyzer determines traffic according to a delta between the first occupancy data and the  
6 second occupancy data.

1 13. The cellular communication device of claim 12 further comprising:  
2 an overlay mechanism for geographically correlating a cell map and a road map in the map  
3 storage.

1 14. The cellular communication device of claim 13 wherein the traffic includes vehicular traffic  
2 and the cellular communication device further comprising:  
3 a display for outputting information depicting the vehicular traffic.

1 15. The cellular communication device of claim 12 further comprising:  
2 a zoom control.

1 16. The cellular communication device of claim 12 further comprising:  
2 means for updating the map storage to store a new map received via the receiver.

1 17. A cellular communication system providing cellular communication to an area including a  
2 plurality of cells, the cellular communication system comprising:

3 first storage to store a cell map;

4 second storage to store cell occupancy data;

5 means for detecting and analyzing a change in the occupancy data of a first cell; and

6 means for changing a functionality of the cellular system's communications in at least one  
7 cell of the plurality of cells.

1 18. The cellular communication system of claim 15 wherein:

2 the means for detecting and analyzing a change in the occupancy data of the first cell detects  
3 a volume of traffic moving into or out of the first cell; and

4 the means for changing alters an amount of bandwidth allocated to a second cell which is  
5 near the first cell.

1 19. The cellular communication system of claim 18 wherein the traffic includes vehicular traffic  
2 traveling on roads that connect various of the cells and wherein the cellular communication system  
3 further comprises:

4 third storage to store a road map of the roads; and

5 a map overlay mechanism to correlate the road map with the cell map.

1 20. The cellular communication system of claim 19 further comprising:

2 means for providing, to cellular devices in communication with the cellular communication  
3 system, information concerning the vehicular traffic flow.

1 21. A method comprising:

2 determining a delta in occupancy data of at least one cell of a cellular communication system;

3 and

4 determining, according to the delta in occupancy data, spatial movement of cellular devices  
5 in communication with the cellular communication system.

1 22. The method of claim 21 wherein the spatial movement comprises substantially planar  
2 movement of vehicular traffic.

1 23. The method of claim 21 wherein the spatial movement comprises three-dimensional  
2 movement of aeronautical traffic.

1 24. The method of claim 21 further comprising:  
2 determining the delta according to a proper subset of available occupancy data for a cell.

1 25. The method of claim 24 further comprising:  
2 randomly selecting the proper subset.

1 26. The method of claim 24 further comprising:  
2 algorithmically selecting the proper subset.

1 27. The method of claim 21 further comprising:  
2 publishing information representing the spatial movement.

1 28. The method of claim 27 wherein the publishing comprises:  
2 transmitting the information to cellular devices in communication with the cellular  
3 communication system.

1 29. The method of claim 28 wherein the information comprises:  
2 a graphical depiction of traffic on roads in the cell occupied by, and neighboring cells of, at  
3 least one cellular device.

1 30. The method of claim 28 wherein the information comprises:  
2 travel routing advice.

1 31. The method of claim 27 further comprising:  
2 selecting, to receive the transmitted information, substantially only those cellular devices  
3 which are subscribed to receive the transmitted information.

1 32. The method of claim 27 wherein the publishing comprises:  
2 sending the information to an entity which is not a cellular device in communication with the  
3 cellular communication system.

1 33. The method of claim 32 wherein the entity comprises at least one of a police department, a  
2 department of transportation, a news bureau, a radio station, a television station, a server computer,  
3 and an internet website.

1 34. The method of claim 21 further comprising:  
2 constructing a set of vectors representing vehicular traffic between cells of the cellular  
3 communication system.

1 35. The method of claim 34 further comprising:  
2 constructing a linear boundary map describing where vehicular roads connect cells.

1 36. The method of claim 21 further comprising:  
2 in response to at least one of the delta and the spatial movement, adjusting functionality of  
3 the cellular communication system.

1 37. The method of claim 36 wherein the adjusting functionality comprises:  
2 increasing capacity of a cell.

1 38. The method of claim 37 further comprising:  
2 in response to at least one of the delta and the spatial movement, predicting a future change in  
3 occupancy of a cell; and  
4 the cell whose capacity is increased is the cell whose occupancy is predicted to have a future  
5 change.

1 39. A method of operation of a traffic estimation system connected to a cellular communication  
2 system which is in communication with a plurality of cellular devices, the method comprising:  
3 receiving cell occupancy data from the cellular communication system;  
4 determining which of the cellular devices represented by the cell occupancy data are moving  
5 between cells of the cellular communication system;  
6 determining which cells the moving cellular devices are moving between; and  
7 converting the moved-between cell determination into a vehicular roadway representation  
8 indicating which roads the moving vehicles are likely to be driving on.

1 40. The method of claim 39 further comprising:

2 ignoring cellular devices which are not traveling between cells for a sufficient time such that  
3 it is likely that they are stationary or only driving short distances within their respective cells.

1 41. The method of claim 39 further comprising:  
2 analyzing only a proper subset of available cell occupancy data; and  
3 extrapolating from the resulting analysis to achieve an estimated result for a larger set of  
4 occupancy data.

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2 42. The method of claim 41 further comprising:  
randomly selecting the proper subset.

1 43. The method of claim 41 further comprising:  
2 algorithmically selecting the proper subset.

1 44. The method of claim 39 further comprising:  
2 publishing information representing the vehicular roadway representation.

1 45. The method of claim 44 wherein the publishing comprises:  
2 transmitting the information to the cellular communication system.

1 46. The method of claim 44 wherein the publishing comprises:  
2 transmitting the information to at least one of the cellular devices.

1 47. The method of claim 46 further comprising:  
2 selecting to receive the transmitted information substantially only those cellular devices  
3 which are subscribed to receive the transmitted information.

1 48. The method of claim 39 further comprising:  
2 performing system validation analysis upon anonymized individual cellular devices.

1 49. A method comprising:  
2 receiving a request for an area traffic analysis in a specified area;  
3 categorizing cellular devices in the specified area;  
4 filtering out cellular devices not recently in other areas;  
5 capturing cellular devices recently arrived from other areas;

eliminating cellular devices departing to other areas;  
reconciling a result with results from nearby areas to produce a result;  
providing the result to an entity from which the request was received.

50. The method of claim 49 further comprising:  
producing a cell-based vector set; and  
converting the vector set into road map format data.

51. The method of claim 50 further comprising:  
making a qualitative interpretation of the road map format data as a traffic flow estimation.

52. An article of manufacture comprising:  
a machine-accessible medium including data that, when accessed by a machine, cause the  
machine to perform the method of claim 21.

53. The article of manufacture of claim 52 wherein the machine-accessible medium further  
including data that, when accessed by the machine, cause the machine to further perform the method  
of claim 24.

54. An article of manufacture comprising:  
a machine-accessible medium including data that, when accessed by a machine, cause the  
machine to perform the method of claim 39.

55. The article of manufacture of claim 54 wherein the machine-accessible medium further  
including data that, when accessed by the machine, cause the machine to further perform the method  
of claim 41.

56. An article of manufacture comprising:  
a machine-accessible medium including data that, when accessed by a machine, cause the  
machine to perform the method of claim 49.

57. The article of manufacture of claim 56 wherein the machine-accessible medium further  
including data that, when accessed by the machine, cause the machine to further perform the method  
of claim 51.